CME Article

Recommendations for Reducing the Risk of Occupational Hiv Transmission

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Hiv infection is an occupational risk for health care workers. To protect these health care workers, the Public Health Service has recommendations for postexposure chemoprophylaxis.

Learning Objectives

i. To identify high risk occupational hiv exposures of health care workers.
ii. To describe antiretroviral regimens to reduce the risk of occupational hiv transmission.
iii. To recognize occupational hiv exposures for which postexposure prophylaxis should be recommended.

The transmission of blood-borne pathogens is an occupational hazard for health care workers. Nationally, as of June 30, 2001, fifty-seven health care workers have become hiv infected as a result of occupational exposures. Twenty-six of these workers have developed aids. The fifty-seven health care workers include twenty-four nurses, nineteen laboratory technicians, six physicians, two surgical technicians, two housekeeper–maintenance workers, one dialysis technician, one respiratory therapist, one health aide–attendant, and one embalmer–morgue technician. The most common route of exposure for occupational hiv transmission is percutaneous. Forty-eight of the seroconversions occurred as a result of a percutaneous exposure, five occurred through a mucocutaneous exposure (mucous membrane and/or skin exposure), two occurred because of combined percutaneous and mucocutaneous exposure, and for two, the route of exposure was unknown.[1]

Risk of Hiv Transmission

The average risk of hiv infection from all types of percutaneous exposures to hiv-infected blood is 0.3%. The Centers for Disease Control and Prevention (cdc) conducted a case-control study to determine the risk of hiv infection from different types of percutaneous exposures. This study showed that the risk of hiv-infection exceeded 0.3% for exposures that involved a deep injury to the health care worker; visible blood on the device that caused the injury; when a device had been placed in the source patient's vascular system (e.g., a needle used for phlebotomy); or when a source-patient died as a result of aids within sixty days postexposure.[2,3]

The increased risk associated in these instances may be related to exposure to larger volumes of blood or to blood containing a higher titer of the hiv virus. However, the utility of viral load measurements from the source patient as a

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disclosure statement: Sindy M. Paul, md, mph, has no relationship to disclose. The article makes some recommendations that are not fda approved.

surrogate for estimating the viral titer for assessing transmission risk is unknown. HIV transmission from those with a viral load below detectable limits has been reported in one health care worker seroconversion and in instances of mother-to-infant transmission.[2,3]

The average risk of HIV infection following a mucous membrane or skin exposure is less than the risk associated with a percutaneous exposure. The average risk of HIV infection after a mucous membrane exposure is 0.09%, while the average risk of HIV infection after a skin exposure is less than 0.09%. The risk for skin exposure may be increased if the skin contact is prolonged, if the contact involves an extensive area of the skin, if the integrity of the skin is not intact, or if the exposure involves a higher titer of HIV.[2,3]

Occupational Exposure Follow-Up

Employers need to provide health care workers with a system for prompt evaluation, counseling, and follow-up after an occupational exposure that places the employee at risk of acquiring an HIV infection.

First aid should be administered immediately after exposure.

- Puncture wounds and other cut injuries should be washed with soap and water.
- Exposure to oral and nasal mucosa should be decontaminated by flushing with water.
- Eyes should be irrigated with clean water and saline or sterile irrigants that are designed for flushing eyes. The exposure should be reported to the person or department (e.g., employee health, infection control) that is responsible for managing exposures.

HIV-antibody tests should be performed at baseline and periodically for at least six months postexposure (e.g., six weeks, twelve weeks, and six months). HIV testing also should be performed on any health care worker who has an illness compatible with an acute retroviral syndrome, regardless of the interval since the exposure. HIV-antibody testing using enzyme immunoassay (EIA) should be used to monitor for seroconversion. The routine use of direct assays (e.g., HIV antigen EIA or polymerase chain reaction for HIV RNA) to detect infection in health care workers is generally not recommended. The reliability of HIV RNA testing to detect very early infection has not been determined, and it is not Food and Drug Administration (FDA) approved for this purpose. The employee should be counseled on precautions to take to prevent secondary transmission of HIV.[3]

Testing to determine the HIV status of an exposure source should be performed as soon as possible. The exposure source should receive pre- and post-test counseling and give consent for HIV testing. Using an FDA approved rapid HIV-antibody test kit should be considered in this situation, particularly if testing by EIA cannot be completed in twenty-four to forty-eight hours. Repeatedly reactive results by EIA or rapid HIV-antibody tests are considered to be highly suggestive of infection, whereas a negative result is an excellent indication that there are no HIV antibodies present. Confirmation of a reactive result by Western blot or immunofluorescent antibody is not necessary before making initial decisions about postexposure management but should be done to complete the testing process and before informing the source person.[3]

Postexposure Prophylaxis

In some instances, appropriate postexposure management includes antiretroviral agents for postexposure prophylaxis (PEP). A multinational study found that PEP with zidovudine (ZDV) decreased the risk of HIV infection by 81% following percutaneous exposure.[4] However, failures have occurred. In sixteen cases, ZDV was used as monotherapy, in two cases ZDV was used with didanosine (ddI), and in three cases three or more drugs were used for PEP. Resistance testing of the virus from the source patient was done in seven instances, and in four, the HIV infection transmitted was found to have decreased sensitivity to ZDV and other drugs used for PEP.[3]

Recommendations

It should be remembered that, even though these recommendations represent the most recent Public Health Service recommendations for PEP, they are subject to change. PEP is not recommended for all types of occupational exposure to HIV because the majority of occupational exposures do not result in HIV transmission.

If PEP is recommended, it should be initiated as soon as possible, even though the interval within which PEP should be initiated for optimal efficacy is not known. While the interval after which no benefit is gained from PEP for humans is undefined, animal studies suggest that PEP probably is substantially less effective if started more than twenty-four to thirty-six hours postexposure. Therefore, if appropriate for the exposure, it is recommended that PEP be started even when the interval since exposure exceeds thirty-six hours. Initiating therapy after a much longer interval (e.g., one-week) might be considered for exposures that represent an increased risk of transmission.

The optimal duration of PEP is unknown. However, because four weeks of ZDV appeared protective in occupational and animal studies, PEP probably should be administered for four weeks, if tolerated.[2,3]

To assist with the initial management of an HIV exposure, health care facilities should have drugs for an initial PEP regimen selected and available for use. Because PEP is potentially toxic, its use is not justified for exposures that pose a negligible risk of transmission. When appropriate, two regimens of PEP are recommended, since insufficient evidence exists to support recommending a three-drug regimen for all HIV exposures. Therefore, two regimens for PEP are suggested: a "basic" two-drug regimen that should be appropriate for most HIV exposures, and an "expanded" three-drug regimen that should be used for exposures that pose an increased risk for transmission. When possible, the regimens should be implemented in consultation with those who have expertise in antiretroviral treatment and HIV transmission.[3]

Most HIV exposures will warrant a two-drug regimen using two nucleoside analogues (e.g., ZDV and lamivudine (3TC); 3TC and stavudine (d4T); or d4T and ddI). The addition of a third drug should be considered for exposures that pose an increased risk of transmission. Selection of the PEP regimen should consider the comparative risk represented by the exposure and information about the exposure source, including history of and response to antiretroviral therapy based on clinical response, CD4+ T-cell counts, viral load measurements, and current disease stage. When the source person's virus is known or suspected to be resistant to one or more of the drugs considered for the PEP regimen, the use of drugs to which the source person's virus is unlikely to be resistant is recommended; expert consultation is advised. If this information is not immediately available, initiation of PEP, if indicated, should not be delayed; appropriate changes in the PEP regimen can be made after PEP has been started. Reevaluation of the exposed person should be considered within seventy-two hours postexposure, especially as additional information about the exposure or source person becomes available.[3] (See tables 1 and 2 for a summary of the PEP recommendations.)

PEP when HIV-infection status of source person is unknown

If the source person's HIV-infection status is unknown at the time of exposure, use of PEP should be decided on a case-by-case basis, after considering the type of exposure and the clinical and/or epidemiologic likelihood of HIV infection in the source (see tables 1 and 2). If these considerations suggest a possibility for HIV transmission, then initiating a two-drug regimen is recommended. Once the source's HIV test results are obtained, the need for PEP and the medications recommended can be reevaluated. The following are recommendations for HIV postexposure prophylaxis:

- If indicated, start PEP as soon as possible after an exposure.
- Consider reevaluating the exposed person within seventy-two hours postexposure, especially

Table 1. Recommended HIV Postexposure Prophlaxis for Percutaneous Injuries

	INFECTION STATUS OF SOURCE				
EXPOSURE TYPE	HIV-POSITIVE CLASS 1*	HIV-POSITIVE CLASS 2*	SOURCE OF UNKNOWN HIV STATUS~	UNKNOWN SOURCE^	HIV-NEGATIVE
Less severe^*	Recommend basic 2-drug PEP	Recommend expanded 3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors~~	Generally, no PEP warranted; however, consider basic 2-drugPEP** in settings where exposure to HIV-infected persons is likely	No PEP warranted
More severe^^	Recommend expanded 3-drug PEP	Recommended expanded 3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP** for source with HIV risk factors~~	Generally, no PEP warranted; however, consider basic 2-drug PEP** in settings where exposure to HIV-infected persons is likely	No PEP warranted

* HIV positive, Class 1—asymptomatic HIV infection or known low viral load (e.g., <1,500 RNA copies/mL). HIV positive, Class 2—symptomatic HIV infection, AIDS, acute serocoversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of postexposure prophylaxis (PEP) should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.

~ Source of unknown HIV status (e.g., deceased source person with no samples available for HIV testing).

^ Unknown source (e.g., a needle from a sharps disposal container).

^* Less severe (e.g., solid needle and superficial injury).

** The designation "consider PEP" indicates that PEP is optional and should be based on an individualized decision between the exposed person and the treating clinician.

~~ If PEP is offered and taken and the source is later determined to be HIV negative, PEP should be discontinued.

^^ More severe (e.g., large-bore hollow needle, deep puncture, visible blood on device, or needle used in patient's artery or vein).

as additional information about the exposure or source person becomes available.

- Administer PEP for four weeks, if tolerated.
- If a source person is determined to be HIV-negative, discontinue PEP.[3]

PEP FOR PREGNANT HEALTH CARE WORKERS

If the exposed person is pregnant, the evaluation of risk of infection and need for PEP should be approached as with any other person who has been exposed to HIV. However, the decision to use any antiretroviral drug during pregnancy should involve discussion between the woman and her health care provider(s) regarding the potential benefits and risks to her and to her fetus.[3]

Pregnant women should avoid certain drugs. Because teratogenic effects were observed in primate studies, (efavirenz) EFV is not recommended

Table 2. Recommended HIV Postexposure Prophlaxis for Mucous Membrane Exposures and Nonintact Skin Exposures*

	INFECTION STATUS OF SOURCE				
EXPOSURE TYPE	HIV-POSITIVE CLASS 1~	HIV-POSITIVE CLASS 2~	SOURCE OF UNKNOWN HIV STATUS^	UNKNOWN SOURCE^*	HIV-NEGATIVE
Small volume **	Consider basic 2-drug PEP~~	Recommend 2-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP~~ for source with HIV risk factors^^	Generally, no PEP warranted; however, consider basic 2-drug PEP~~ in settings where exposure to HIV-infected persons is likely	No PEP warranted
Large volume^*^*	Recommend basic 2-drug PEP	Recommend expanded 3-drug PEP	Generally, no PEP warranted; however, consider basic 2-drug PEP~~ for source with HIV risk factors^^	Generally, no PEP warranted however, consider basic 2-drug PEP** in settings where exposure to HIV-infected persons is likely	No PEP warranted

* For skin exposures, follow-up is indicated only if there is evidence of compromised skin integrity (e.g., dermatitis, abrasion, or open wound).

~ HIV positive, Class 1—asymptomatic HIV infection or known low viral load (e.g., <1,500 RNA copies/mL). HIV-Positive, Class 2—symptomatic HIV infection, AIDS, acute serocoversion, or known high viral load. If drug resistance is a concern, obtain expert consultation. Initiation of postexposure prophylaxis (PEP) should not be delayed pending expert consultation, and, because expert consultation alone cannot substitute for face-to-face counseling, resources should be available to provide immediate evaluation and follow-up care for all exposures.

^ Source of unknown HIV status (e.g., deceased source person with no samples available for HIV testing).

^* Unknown source (e.g., splash from inappropriately disposed blood).

** Small volume (e.g., a few drops).

~~ The designation "consider PEP" indicates that PEP is optional and should be an individualized decision between the exposed person and the treating clinician.

^^ If PEP is offered and taken and the source is later determined to be HIV-negative, PEP should be discontinued.

^*^* Large volume (e.g., major blood splash).

during pregnancy. Reports of fatal lactic acidosis in pregnant women treated with a combination of d4T and ddl have prompted warnings about these drugs during pregnancy. Because of the risk of hyperbilirubinemia in newborns, indinavir (IDV) should not be given to pregnant women shortly before delivery.[3]

Monitoring and Side Effects

If PEP is used, possible drug-toxicity needs to be monitored. This should include a complete blood count and renal and hepatic chemical function tests at baseline and two weeks after starting PEP. Monitoring for hyperglycemia should be included

for PEP regimens that include a protease inhibitor. If IDV is included in the regimen, monitoring for crystalluria, hematuria, hemolytic anemia, and hepatitis also should be done. If toxicity is noted, dose reduction or drug substitution should be considered, and an expert should be consulted. Further diagnostic studies may be indicated. Health care workers who become HIV infected should receive appropriate medical care. Side effects may make adherence to PEP difficult. Common symptoms associated with many of nucleoside reverse transcriptase inhibitors (NRTIs) are chiefly gastrointestinal, such as nausea or diarrhea. Other common symptoms include headache, malaise, fatigue, or insomnia. However, serious side effects, including nephrolithiasis, hepatitis, and pancytopenia, have been reported with combination PEP. These symptoms often can be managed without changing the regimen by prescribing antimotility and antiemetic or other medications that target specific symptoms. In other situations, modifying the dose interval (e.g., administering a lower dose more frequently throughout the day, as recommended by the manufacturer) may help promote adherence to the regimen.[3]

All the FDA-approved protease inhibitors (PI) have potentially serious drug interactions. Therefore, careful evaluation of interactions with concomitant medications is necessary before prescribing a PI.

The Public Health Service recommendations for PEP are intended to provide guidance to physicians. They can be modified by local experts on a case-by-case basis. Whenever possible, expert consultation is recommended.

Resources for Consultation

Clinicians can seek consultation on HIV PEP from local experts. In addition, the National Clinicians' Postexposure Hotline (888-448-4911) has been created to assist clinicians with these issues. Needlestick!, a website to help clinicians manage and document occupation blood and body fluid exposures can be used by going to their site at http://www.needlestick.mednet.ucla.edu. Unusual or severe toxicity to antiretroviral agents can be reported to the FDA at 800-332-1088. HIV seroconversions in health care workers who received PEP can be reported to CDC at 800-893-0485. *NJM*

References

1. Centers for Disease Control and Prevention. *HIV/AIDS Surveillance Report*, 2002.

2. J. I. Tokars et al. "Surveillance of HIV Infection and Zidovudine Use among Healthcare Workers after Occupational Exposure to HIV Infected Blood," *A Intern Med* 118 (1993): 913–919.

3. Centers for Disease Control and Prevention. "Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis," *MMWR* 50, no. RR-II (2001): 1–52.

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CME EXAMINATION: DEADLINE SEPTEMBER 30, 2004

"Recommendations for Reducing the Risk of Occupational Hiv Transmission"

1. The recommended length of time for occupational postexposure prophylaxis for health care workers is:
   A. 4 hours
   B. 4 days
   C. 4 weeks
   D. 4 months

2. Which of the following holds the highest risk of exposure for HIV transmission?
   A. Eye splash while suctioning an incubated patient
   B. Intraoperative cut from a scalpel
   C. Needlestick injury after phlebotomy
   D. Wound drainage on non-intact skin

3. Which of the following antiretroviral agents is contraindicated for postexposure prophylaxis for pregnant women?
   A. Efavirenz
   B. Indinavir
   C. Lamivudine
   D. Zidovudine

4. For which of the following health-care-worker needlestick exposures to an asymptomatic HIV-infected patient should zidovudine (AZT, ZDV) plus lamivudine (3TC) be recommended for postexposure prophylaxis?
   A. After removing an arterial line
   B. After suturing a wound
   C. Prior to performing phlebotomy
   D. Prior to starting an IV

5. Which of the following tests is recommended to determine the HIV status of an exposure source as quickly as possible?
   A. CD4+ T cell count
   B. Enzyme immunoassay (EIA)
   C. Rapid HIV test
   D. Viral load for HIV

Answer Sheet

"Recommendations for Reducing the Risk of Occupational Hiv Transmission"

Darken the correct answers

1. [A] [B] [C] [D] 2. [A] [B] [C] [D] 3. [A] [B] [C] [D]
4. [A] [B] [C] [D] 5. [A] [B] [C] [D]

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